bundle presents a surface fifty times smaller than that of the cortical motor zone in which these fibres terminate. A lesion of the same extent would therefore entrain the degeneration of a greater number of fibres, when it involves the third posterior fourth of the internal capsule, than when it occupies the motor zone of the convolutions.

The distance from the side of the cord the degeneration extends in the anterior and lateral columns, and its extent in length present as many variations as does the distribution of the different bundles of the pyramidal fibres in this portion of their course.

When the degeneration occupies two homologous columns of the cord at the same time, it may be consecutive to a bilateral lesion of the hemispheres, or to a lesion involving the cord itself.

Secondary degenerations of the pyramidal fibres appear to have no reaction on the grey nuclei of the medulla and on the grey matter of the anterior horns.

From all this, Flechsig concludes that the secondary degeneration of the pyramids constitute rather a lesion of an elementary system of fibres.

In a last article, he defends his method of investigation, based on embryogenic researches and the anatomical results obtained with its use, against the attacks upon it by Mayser. To the results of Flechsig Mayser had opposed, in a recent article (*Arch. f. Psychiatrie*, VII.) the results obtained by him in experiments of viviseetions of new-born animals.

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Primary Degenerations of the Pyramidal Bundles.—In a third article Flechsig undertakes to study the localization and the precise nature of the lesions met with in the spinal disorder described by Professor Charcot under the name of amyotrophic lateral sclerosis.

I. The lesions of amyotrophic sclerosis are essentially a primary and symmetrical lateral sclerosis of the white lateral columns, a destructive atrophy of a great number of multipolar cells in the anterior horns, and a degeneration of a considerable number of the motor fibres of the anterior roots. But Flechsig endeavors solely to show that these different elements thus involved belong all to one system, which represents the most direct route of transmission connecting the cortical motor centres with the peripheral muscles.

*a.* Thus the lesions involving the white substance of the cord will not be limited to the lateral columns taken in their *ensemble*, as Charcot would have it. According to Flechsig, of all the cases of amyotrophic lateral sclerosis collected by M. Charcot, only six can be utilized in solving this question of localization.

But, in analyzing these six observations, the German author comes to the conclusion that the lesion of the white substance always reaches its greatest intensity at the horizon of the pyramidal bundles, as he understands them. (See above.) In the majority of cases one part (the smallest) of the pyramidal bundles passes along the anterior columns, while the other forms the posterior segment of the lateral columns. These are the place of election of the lesion in amyotrophic lateral sclerosis, only because they usually contain

the greater part of the pyramidal fibres. But the anterior columns are likewise involved in the majority of cases. If they are not always involved this is owing to the distribution of the pyramidal fibres in the cord. It may happen, indeed, that all the pyramidal fibres decussate in the medulla and pass down in the lateral column of the opposite side; in this case they are lacking in the anterior columns.

It is none the less true that, in amyotrophic sclerosis, the lesion rather frequently involves that part of the lateral columns that is not composed of the pyramidal fibres. In one case even the posterior columns (more especially the columns of Goll) were invaded.

Supporting himself on the preceding facts, Flechsig criticizes the name primary symmetrical lateral sclerosis. This name has the great inconvenience of losing sight of the fact that the only system constantly invaded is the system of the pyramidal fibres, which is habitually distributed in the anterior and lateral columns; and on the other hand the lesion, in lateral amyotrophic sclerosis, is not truly symmetrical except when the distribution of the pyramidal fibres in the cord is itself symmetrical, which is not always the case. Finally, he does not admit as yet demonstrated, that the lesion has always the white substance as its starting-point.

On these different accounts, he proposes to substitute for the term adopted by M. Charcot, the name primary fascicular sclerosis of the pyramidal bundles. We must, moreover, distinguish a simple and a complicated form, according as the anatomical lesion remains limited to the pyramidal bundles, or invades those adjoining.

*b.* The lesions of the grey substance consist in an atrophy with complete degeneration of the multipolar cells which we find in the anterior horns; that is to say, of the nervous elements that are in direct communication with the pyramidal fibres of the anterior lateral columns. Moreover, the nervous elements which in the medulla are, in a fashion, the homologues of the great motor cells of the anterior horns, seem to be the only ones there involved in cases of amyotrophic lateral sclerosis.

*c.* In the typical cases of amyotrophic lateral sclerosis, the lesion spares the posterior roots, and only invades those fibres of the anterior roots whose axis cylinders are merely the prolongations of the ganglion cells of the anterior horns. It consists in a degeneration of the nervous elements; the interstitial tissue remaining intact. Moreover, at different horizons the number of altered fibres appears to be in relation with the corresponding number of degenerated multipolar cells.

In fine, Flechsig comes to the conclusion that in a certain proportion of cases of amyotrophic lateral sclerosis, the lesion involves, sometimes exclusively, sometimes in a predominant way, a collection of nervous elements which maintain very intimate functional relations. These elements (pyramidal fibres, multipolar cells of the anterior horns, motor fibres of the anterior roots) constitute what Flechsig calls the *direct cortico-muscular system*, that is, the most direct route of transmission from the grey cortex of the convolutions to the motor cells of the anterior horns whence originate the motor fibres destined to the striated muscles. In fact, as has been said before in the analysis of the anatomical part of Flechsig's memoir, the pyra-

midal fibres, according to the author, extend directly from the peduncles to the cortex, without touching the central ganglia of the hemispheres.

II. In a special chapter the author discusses lengthily the histological character of the lesion of the white substance of the cord in amyotrophic sclerosis. He is disposed to admit that it is rather a primary degeneration of the nerve fibres, and not a primary hyperplasia of the interstitial connective tissue with secondarily atrophy of the compressed nerve elements. But in fact, direct proofs derived from microscopic examination are lacking, and Leyden claims that, in a proportion of cases of amyotrophic sclerosis, the lesion primarily affects the neuroglia, and that the atrophy of the nerve elements is only a secondary alteration.

In reality, according to Flechsig, the differences noticed by Leyden in various cases of amyotrophic sclerosis, are not more marked than those which are found in the comparison of a number of cases of secondary degeneration, some recent and others of older date.

Moreover, the systematic distribution of the lesion in the majority of cases of amyotrophic sclerosis, is a sufficient reason for holding that the primary trouble is in the nerve elements. Indeed, the different systems of fibres which by their union form columns of the cord, are nourished by a single vascular net-work, and the connective tissue which serves as a support to both vessels and nerve fibres, is alike in all. We do not see, therefore, says he, why a lesion having its point of departure in the interstitial connective tissue and limited to a small portion of the transverse section of the cord, should propagate itself through the whole length of the spinal axis without involving the whole of its white substance.

In closing, the author announces that in a later communication he proposes to define the precise *role* that the direct cortico-muscular transmission system plays in the amyotrophic lateral sclerosis of Charcot.

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Partial Nerve-Section.—In the *Archiv f. Anat. und Phys.* (1878, III. and IV., p. 218), Dr. I. Steiner describes a method of splitting the vagus longitudinally (in rabbits). The best spot for the operation is the part immediately below the ganglion of the vagus, where the nerve is flattened. On testing the artificially separated bundles, it was found that the external bundle comprised only the sensory fibres, while the internal half consisted of the motor filaments innervating the heart, larynx and œsophagus.

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Degeneration of S red Nerves.—After a methodic study of the degeneration of the peripheral stump of the divided sciatic nerve (Guinea-pig) Guiseppe Colasanti (*Archiv f. Anat. und Phys.*, 1878, III. and IV., p. 206) claims that we must distinguish between the degeneration proper, which is not observable until after the lapse of 72 hours, and the traumatic change found in the peripheral stump, extending as far as the first annular constriction.

This change, quite marked within 24 hours after the division, consists in